

REMARKS/ARGUMENTS

Claims 11-19, 21-26, and 42-46 are pending in this application. By this Amendment, Applicant amends Claims 11 and 18, 19, 21, and 22, cancels Claims 20 and 27-41, and adds Claims 42-46.

Applicant has canceled Claims 27-41 because these claims are directed to a non-elected invention. Applicant reserves the right to file a Divisional Application to pursue prosecution of Claims 27-41

Claims 11-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Fetouh (U.S. 4,569,109). Applicant has canceled Claim 20. Applicant respectfully traverses the rejection of Claims 11-19 and 21-26.

Claim 11 has been amended to recite:

A breaking and splitting structure of a connecting rod comprising:  
a large end having a crank pin bore, the large end being broken and split into a rod section and a cap section such that the rod section and the cap section have broken and split surfaces, the rod and cap sections being coupled to each other via fastening bolts such that the broken and split surfaces of the rod section and the cap section are engaged and aligned with each other; wherein

a breakage-starting portion extending in the axial direction of the crank pin bore is formed in an inside circumferential surface of the crank pin bore of the large end, and the axial length of the breakage-starting portion is less than the axial length of the inside circumferential surface; and

**the breakage-starting portion extends from one end of the crank pin bore to a location just short of a middle of the axial length of the crank pin bore. (emphasis added)**

Claim 18 has been amended to recite:

A breaking and splitting structure of a connecting rod comprising:  
a large end having a crank pin bore, the large end being broken and split into a rod section and a cap section such that the rod section and the cap section have broken and split surfaces, the rod and cap sections being coupled to each other via fastening bolts such that the broken and split surfaces of the rod section and the cap section are engaged and aligned with each other; wherein

a breakage-starting portion extending in the axial direction of the crank pin bore is formed in an inside circumferential surface of the crank pin bore of the large end, and the axial length of the breakage-starting portion is less than the axial length of the inside circumferential surface; and

**the breakage-starting portion is defined by a plurality of pores formed in the crank pin bore.** (emphasis added)

Claim 19 has been amended to recite:

A breaking and splitting structure of a connecting rod comprising:  
a large end having a crank pin bore, the large end being broken and split into a rod section and a cap section such that the rod section and the cap section have broken and split surfaces, the rod and cap sections being coupled to each other via fastening bolts extending through bolt holes in the rod section such that the broken and split surfaces of the rod section and the cap section are engaged and aligned with each other; wherein

a breakage-starting portion extending in the axial direction of the crank pin bore is formed in an inside circumferential surface of the crank pin bore of the large end, and the axial length of the breakage-starting portion is less than the axial length of the inside circumferential surface; and

**the axial length of the breakage-starting portion is substantially equal to or less than a diameter of the bolt holes.** (emphasis added)

With the unique combination and arrangement of features recited in Applicant's Claims 11, 18, and 19, including the specific features of the breaking-starting portion recited therein, Applicant has been able to provide a breaking and splitting structure of a connecting rod that prevents generation of burrs that occur when the broken and split surface is displaced from the breakage-starting groove and also prevents deterioration of reproducibility in aligning the broken and split surfaces with each other, thus preventing engine trouble. (see, for example, the second full paragraph on page 2 of the originally filed specification).

The Examiner alleged that Fetouh teaches all of the features recited in Applicant's Claims 11, 18, and 19, except for the lengths of the notches as recited Claim

11 and 19, and the shape of the notches as recited in Claim 18. The Examiner further alleged, "it is well held that discovering an optimum value of a result-effective variable involves only routine skill in the art.... In the instant case, the length and the shape of the notches are result-effective variables, because they would directly affect the degree of the bending deformation during the fracture and the additional machining required after the separation as disclosed by Fetouh ('109)(col. 2, lines 15-36)." Thus, the Examiner concluded, "it would have been obvious to one skilled in the art to have optimized the length and the shape of the notches of Fetouh ('109) in order to minimize the deformation and the additional machining."

Although Applicant respectfully disagrees with the Examiner's allegation that claims 11, 18, and 19 would have been obvious over Fetouh, in order to advance prosecution, Applicant has amended Claim 11 to include the feature recited in Claim 20, amended Claims 18 and 19 to be in independent form including all of the features recited in Claim 11, canceled Claim 20, amended Claims 21 and 22 to depend on Claim 18, and added new Claims 42-46 which depend on Claims 18 and 19.

Col. 2, lines 15-36 of Fetouh disclose:

The present invention provides methods and apparatus for making split bearing assemblies which substantially reduce the amount of machining over the most common methods. The methods and apparatus of the present invention utilize novel fracture techniques that eliminate problems of bending deformation during fracture and avoid the necessity for additional machining after separation. The novel methods are applicable not only to connecting rods and similar items to which fracture separation has been previously applied, but also to components having a plurality of bearing caps connected to a single body, such as an engine block, to provide a novel assembly. Novel splitting apparatus are provided for the manufacture of engine blocks and the like.

The various features and advantages of the method and apparatus as well as the novel structures involved will be more completely disclosed and understood in the following description of certain specific embodiments, chosen for purposes of illustration, together with the accompanying drawings.

Neither this portion nor any other portion of Fetouh teaches or suggests anything at all about the specific length or shape of the notches 42, 44, 84, 85. Thus, contrary to the Examiner's allegations, Fetouh clearly fails to teach or suggest that the length or shape of the notches 42, 44, 84, 85 is a result-effective variable. Quite to the contrary, Fetouh specifically teaches a method and apparatus for making split bearing assemblies which reduces the amount of machining over common methods. Particularly, col. 4, lines 22-66 of Fetouh disclose:

When the material along the split planes is, or has been made, sufficiently brittle, force applying means are utilized to apply a separating force on opposite sides of the bore 34, acting outwardly in opposite directions parallel to the longitudinal axis of the connecting rod, as shown by the arrows in FIG. 4 of the drawings. The application of force in this manner causes tension across the split planes extending outwardly from the notches on opposite sides of the opening 34. The tension causes a crack 45 to progress from the edge of either one of the notches 44 generally along the normal split plane 39 to the outer edge of the connecting rod, causing fracture separation of one pair of the mating legs, in this case 24 and 28, and forming their mating ends as previously described. (If desired the tension can be restricted to a selected one of the split planes. Also other means for limiting initial cracking to one pair of legs can be applied as will be discussed subsequently.)"

**After cracking of one pair of legs, continued force application along the connecting rod longitudinal axis, causing further expansion of the opening 34, would cause the formation of a second crack along the split plane 38, on the opposite side of the connecting rod and result in fully separating the cap and main body. However, experience has shown that completing the fracture in this manner may cause excessive bending of the material at the outer edges of the mating legs defined by the second crack. This bending results in deformation of the material along the outer edge which can interfere with proper mating engagement of the cap and main body upon attempted reassembly of the two members. Thus, it is advisable to provide means to prevent excessive opening of a space at the point of crack 45 which would allow the development of bending stresses to the material in the opposite split plane.**

This may be accomplished, as shown in FIG. 5, by applying a clamping force on opposite ends of the initially separated legs after the crack 45 has been formed. Continued application, or reapplication,

of the longitudinal separating force against the cap and main body sides of the bore 34 is, then, effective to create a second crack 46, starting from the notch 42 and extending outwardly, generally in the split plane 38 to the outer edge of the rod, causing fracture separation of the mating legs 22, 26 and forming their mating ends. (emphasis added)

Thus, in Fetouh, deformation and additional machining is minimized by applying a clamping force on opposite ends of the initially separated legs after the crack has been formed, not by providing notches having a specific length and shape as alleged by the Examiner.

Further evidence that the notches 42, 44, 84, 85 of Fetouh have absolutely nothing to do with minimizing deformation and additional machining can be found in the embodiment shown in Figs. 12 and 12a of Fetouh. Particularly, Figs. 12 and 12a and col. 6, lines 34-58 of Fetouh describe an embodiment of the invention in which no notches are provided. The fact that Fetouh teaches that the deformation and additional machining of the split bearing can be minimized without any notches being provided clearly indicates that, contrary to the Examiner's allegations, the length and shape of the notches 42, 44, 84, 85 of Fetouh are not result-effective variables, and in fact, are not even necessary in the method and apparatus of Fetouh.

Therefore, Applicant respectfully submits that, contrary to the Examiner's allegations, it would not have been obvious to one skilled in the art to have optimized the length and the shape of the notches of Fetouh in order to minimize the deformation and the additional machining. Thus, Applicant respectfully submits that Fetouh certainly fails to teach or suggest the feature of "the breakage-starting portion extends from one end of the crank pin bore to a location just short of a middle of the axial length of the crank pin bore" as recited in Applicant's Claim 11, the feature of "the breakage-starting portion is defined by a plurality of pores formed in the crank pin bore" as recited in Applicant's Claim 18, and the feature of "the axial length of the breakage-starting portion is substantially equal to or less than a diameter of the bolt holes" as recited in Applicant's Claim 19.

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Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of Claims 11, 18, and 19 under 35 U.S.C. § 103(a) as being unpatentable over Fetouh.

In view of the foregoing amendments and remarks, Applicant respectfully submits that Claims 11, 18, and 19 are allowable. Claims 12-17, 21-26, and 42-46 depend upon Claims 11, 18, and 19, and are therefore allowable for at least the reasons that Claims 11, 18, and 19 are allowable.

In view of the foregoing amendments and remarks, Applicant respectfully submits that this application is in condition for allowance. Favorable consideration and prompt allowance are solicited.

The Commissioner is authorized to charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account No. 50-1353.

Respectfully submitted,

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